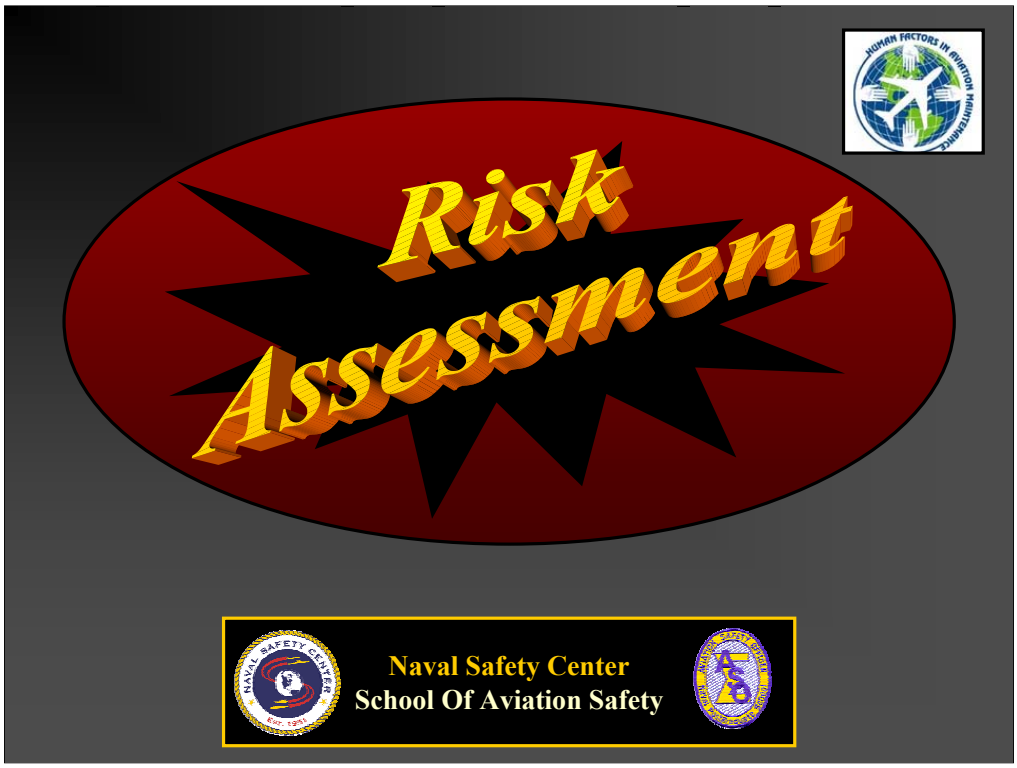
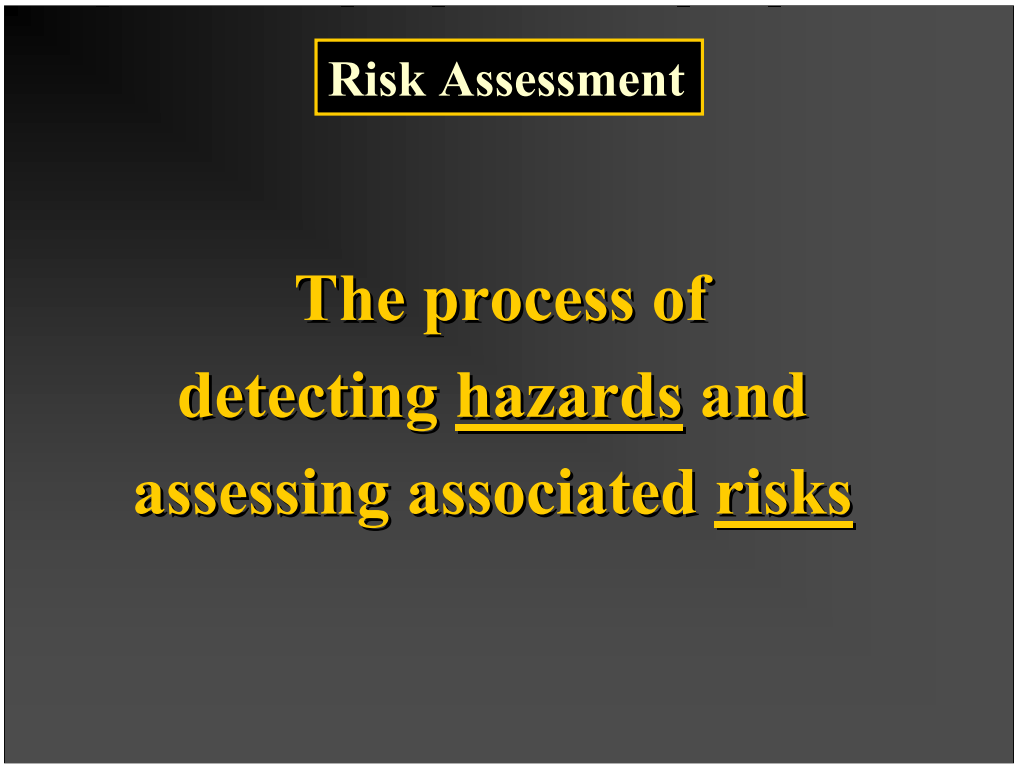


Presentation Time: 1.5 Hours

Welcome to this Risk Assessment presentation. Our goal is to teach you how to analyze hazards for their potential risk to cause future accidents.

With this knowledge, you will be able to prioritize corrective actions to prevent those future accidents.



What is Risk Assessment?

The process of detecting hazards and assessing associated risks.

Hazards and Risks

Hazard – A condition with the potential to cause personal injury or death, property damage, or operational degradation

Risk - An expression of *possible* loss in terms of probability and severity

Hazards and Risks are not the same!

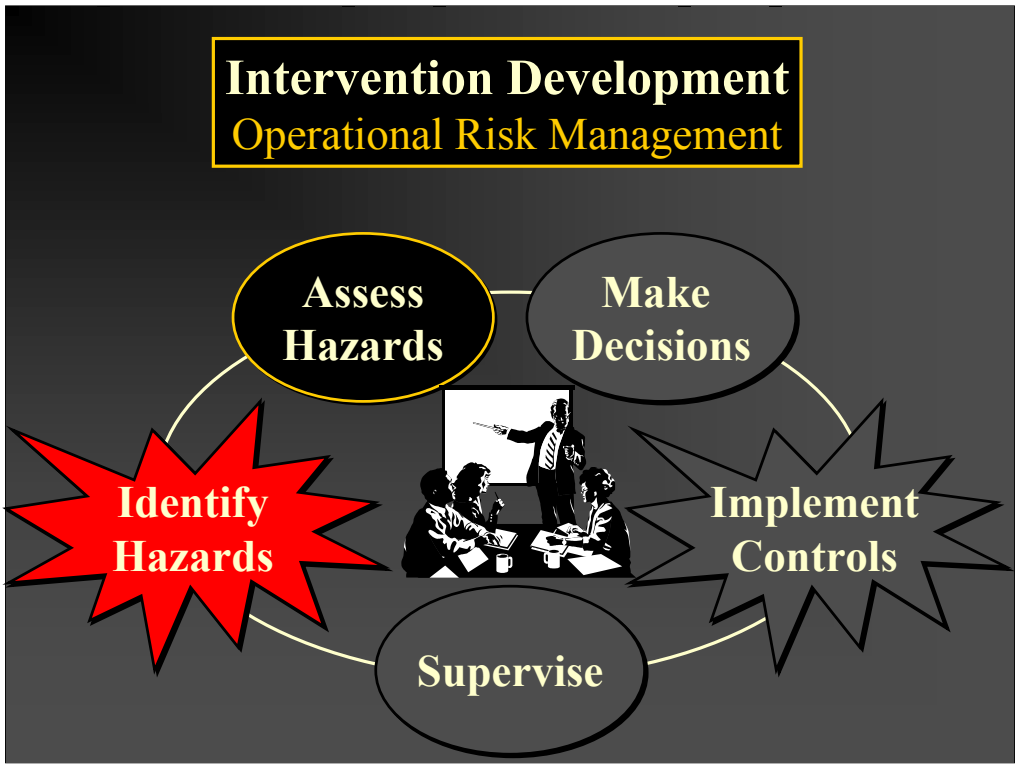
Hazard – A condition with the potential to cause personal injury or death, property damage, or operational degradation

Risk – An expression of *possible* loss in terms of probability and severity

Example: Driving on icy roads is a hazardous condition**.**

- Risk is lessened by driving slow while using snow tires or chains (less probability of slipping and less damage if you go in the ditch at a slower speed).
- Risk is increased with speed or bald tires (higher probability of slipping and greater damage on impact).
- Risk is zero if you don't drive at all, even though the hazard still exists! However, if we don't drive at all, we won't "get the job done" either!

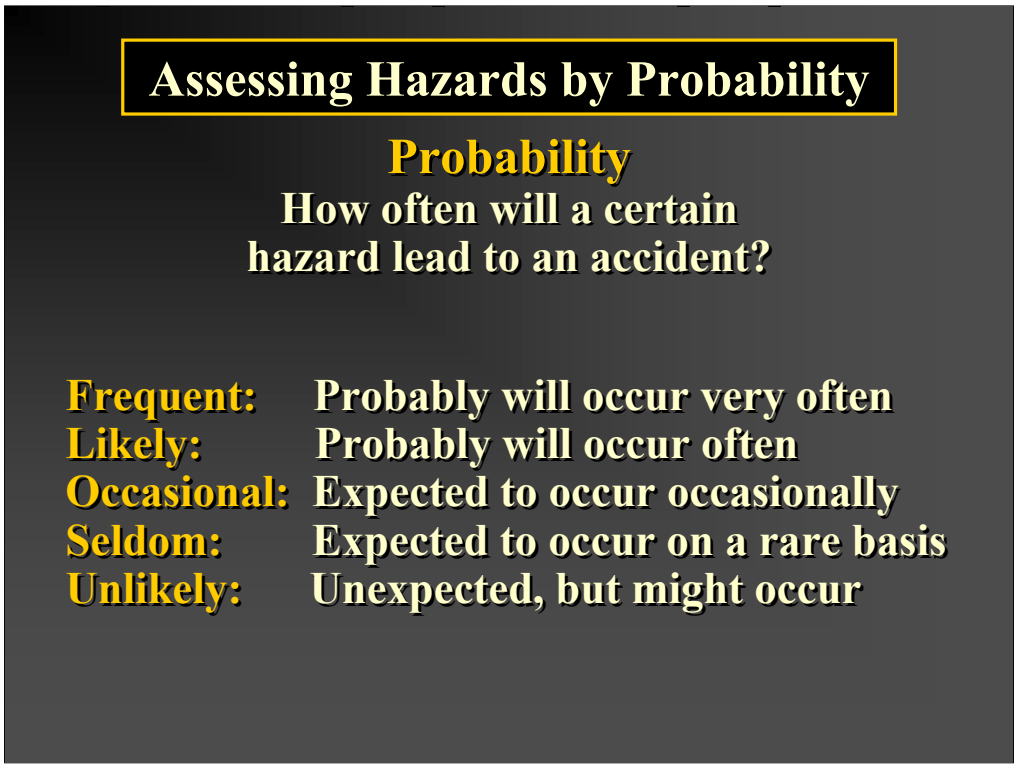
Risk Management allows us to still do the job, but with the safest (less risk) method.



Operational Risk Management is a method of identifying and controlling risks.

This lesson will focus on the first two steps of Risk Management…the Identification of Hazards and Assessing Hazards.

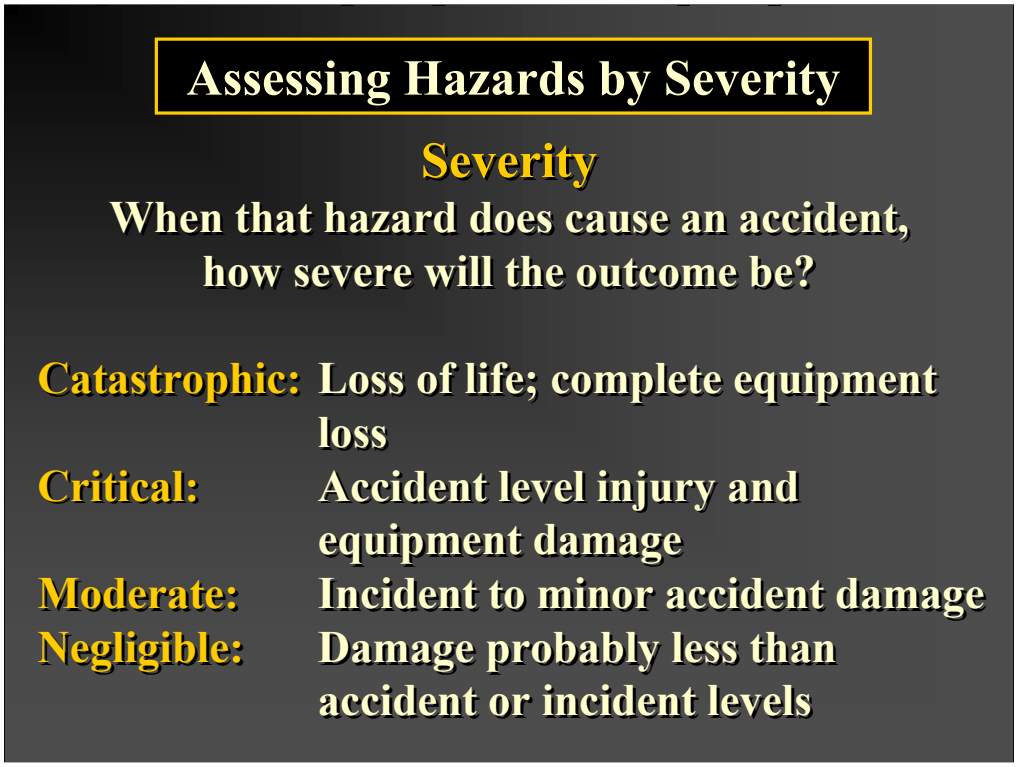
(Quickly go to next slide)



Probability is the likelihood of an accident with a given hazard.

This can happen on a:

Frequent, **Likely**, **Occasional**, **Seldom**, or **Unlikely** basis.



Severity describes the highest level of damage possible when an accident occurs from a particular hazard.

Damage can be:

Catastrophic, **Critical**, **Moderate**, or **Negligible**

For example: Ergonomic hazards may result in Negligible, Moderate, or even Critical levels of accidents, depending on tasks (e.g., typing or lifting heavy materials). But using inadequate tools when jacking an aircraft may result in Catastrophic aircraft damage or death.

Combining Probability and Severity

RISK

Extremely High Risk:

A hazardous condition may cause *frequent* accidents which may result in *catastrophic* equipment losses, injury, or death.

Low Risk:

A hazardous condition is *unlikely* to cause accidents, and even if it does, results in only *negligible* damage.

So Risk is a combination of *Probability* and *Severity*.

Risks can range from Low to Extremely High Levels.

Risk Elimination?

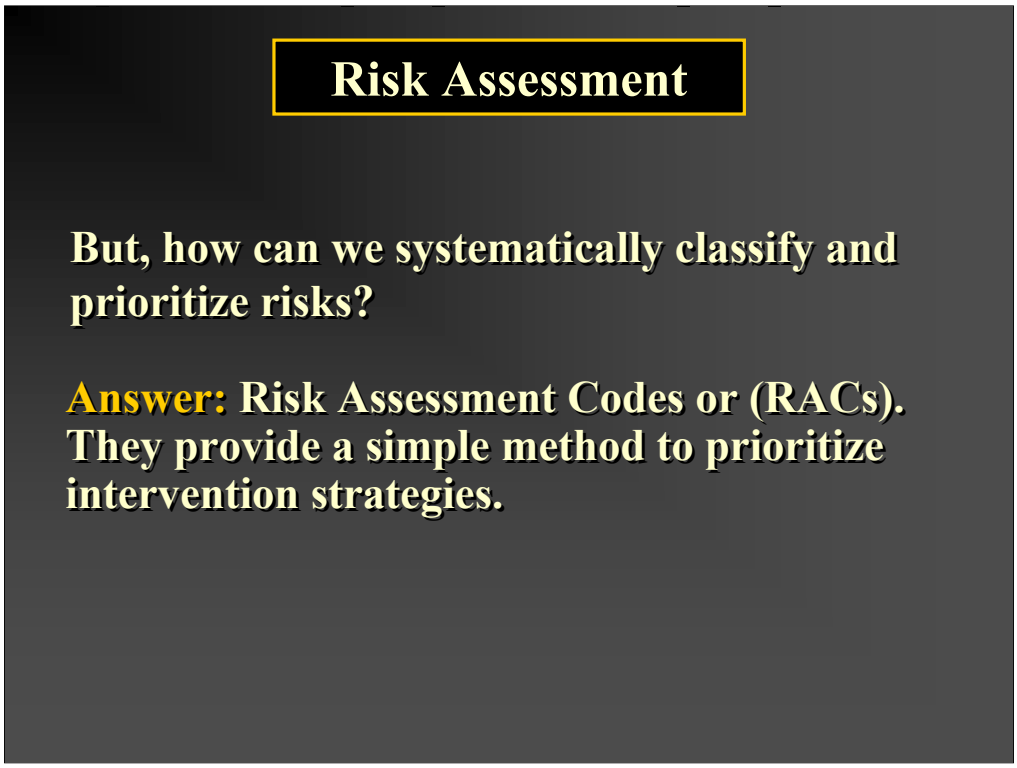
All accident causal factors (hazards) should be eliminated, however, we may not have the resources to immediately accomplish it.

We must then prioritize our corrective actions by addressing High Risks before Low Risks.

But why bother to classify risks at all? Shouldn't we just eliminate all hazards and their associated risks?

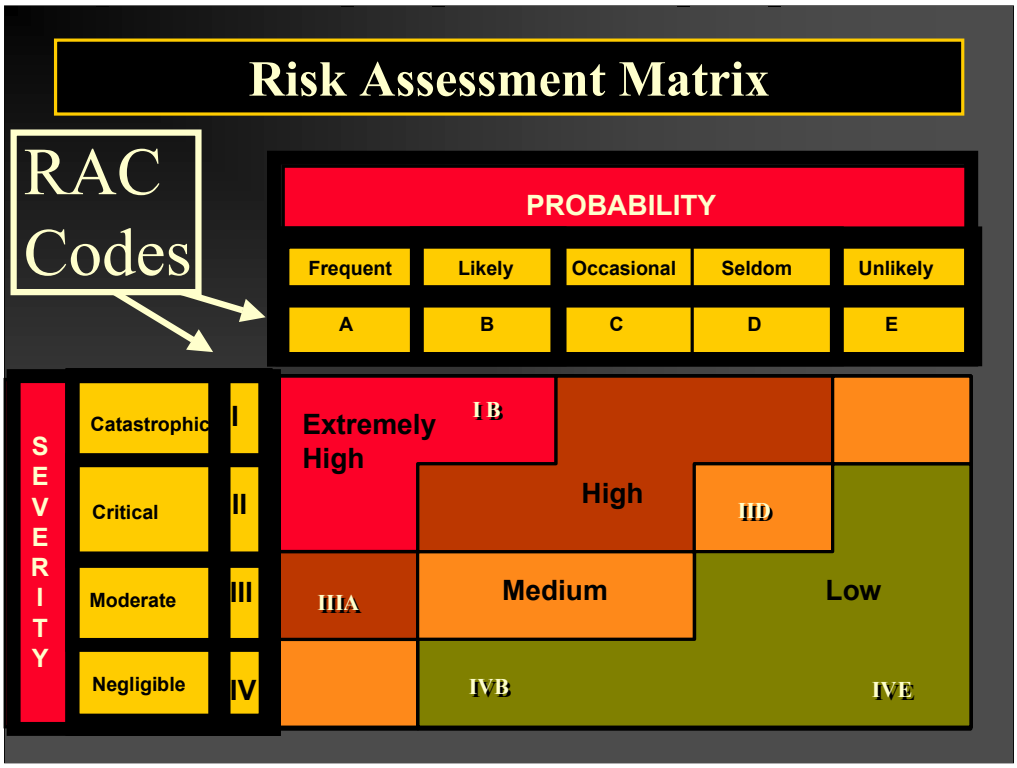
If it were possible yes, but sometimes we don't have the resources (authority, personnel, equipment, support, budget, etc.) to accomplish it.

If we don't have infinite resources, we must then prioritize our actions by identifying and eliminating the higher risks before we devote too many resources to the lower risks.



But, how can we systematically classify and prioritize risks?

Answer: Assign **Risk Assessment Codes (RACs)**. RACs provide a simple method to prioritize intervention strategies.



Facilitator: Click for each "slide build"

The Risk Assessment Matrix is really quite easy to use. It illustrates the relationship between Probability, Severity, Risk Levels, and RAC Codes.

Probability vs. Severity

- First, notice the "boxed" section along the top of the Matrix for **Probability** (Unlikely through Frequent).
- Likewise, the **Severity** "box" contains damage levels (Negligible through Catastrophic).

As Risk is determined by a combination of Probability and Severity, the main area of the Matrix reveals the Risk Levels. The levels are Low, Medium, High, and Extremely High.

To have a low level of risk, we must have a somewhat limited probability and level of severity. Notice that a Hazard with Negligible Accident Severity is usually Low Risk, but it could become a Medium Risk if it occurs frequently. Likewise, a Hazard with a Critical Accident Severity Level could be a Low Risk if it almost never happens. Extremely High Risk is the smallest level, but it has the greatest potential for disaster as Critical/Catastrophic damages are Likely/Frequently going to occur!

The **Risk Assessment Codes (RACs)** are simply Roman Numerals and Letters combined to easily label the Severity and Probability Combinations that form the Levels of Risk. Notice that:

Catastrophic (I) and Likely (B) form RAC IB, which denotes an Extremely High Risk.

Moderate - Frequent (RAC IIIA) is a High Risk.

Critical - Seldom (RAC IID) is a Medium Risk, and

Negligible - Likely (RAC IVB) and Negligible – Unlikely (RAC IVE) are both Low Risks.

Let us now use the risk assessment process in a couple of case examples. (quickly go to next slide)

RAC Example

Inappropriate equipment was used to wash an aircraft.

Inadequate Brushes

Damage to aircraft/people from brushes would be *Negligible* (IV).
Accidents are *Unlikely* from using inappropriate brushes (E).

RAC Code is IVE…a Low Risk.

Let us assume we just discovered a potential Hazard in washing aircraft with inappropriate equipment (inadequate brushes).

The damage (Severity) to the aircraft, or to personnel, by using a different kind of brush would be Negligible (IV), limited to probably only minor scratches.

The probability of an accident at all, is Unlikely (E).

So, the RAC is IVE….a Low Risk.

RAC Example

What if goggles were not used during the aircraft wash?

Lack of Goggles

Damage to the aircraft is certainly *Negligible*, but eye injuries could be *Critical (II)*. Not using goggles on aircraft washes may cause eye accidents (*Seldom-D*).
Critical II and Seldom D: RAC IID - A Medium Risk.

But what if we took this same scenario and changed the inappropriate equipment from brushes to goggles?

The damage to aircraft would be non-existent or Negligible, however personal injury, in the form of eye damage, could be Critical (II).

The probability of an accident from not using goggles is not an everyday occurrence, but it will happen on seldom occasions (D). Note: Remember, even though they do not have goggles (100% of the time for this hazard), it will only be an accident if fluid enters and damages the eyes (much less than 100%, or more likely, on a seldom basis).

So, this aircraft washing scenario has a RAC of IID, a Medium Risk.

RAC Example

Task Change: Welding, without goggles!

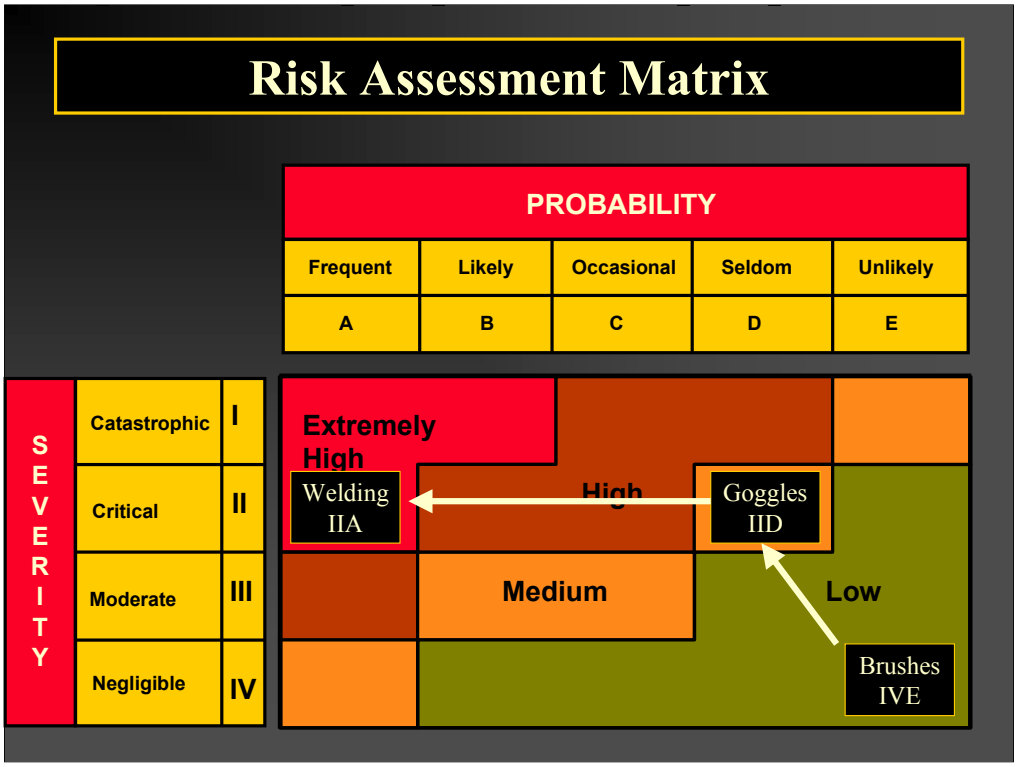
Damage to the aircraft components could be *Moderate*, but eye injuries could be *Critical (II)*. Not using goggles during welding will *Frequently* (A) cause accidents.
Critical (worst case) II and Frequent A: RAC IIA
An Extremely High Risk!

Finally, let us take the 'lack of goggles" and apply it to a different task, one that obviously has more potential to damage the eyes.

Welding aircraft components without goggles could potentially produce Moderate damage to the components, but would cause Critical eye injury (II).

The probability of having accident level injuries to the eyes would be very high without welder's goggles (Frequent –A).

This RAC is IIA…an Extremely High Risk!



Given our "inappropriate equipment" hazards, the risk levels changed dramatically based upon severity of damage and the probability of accident level occurrence.

Inappropriate Brushes for Aircraft washes were a Low Risk. As you can see, the potential for damage was low with brushes…no matter what the task. It was also an unlikely cause of any accident.

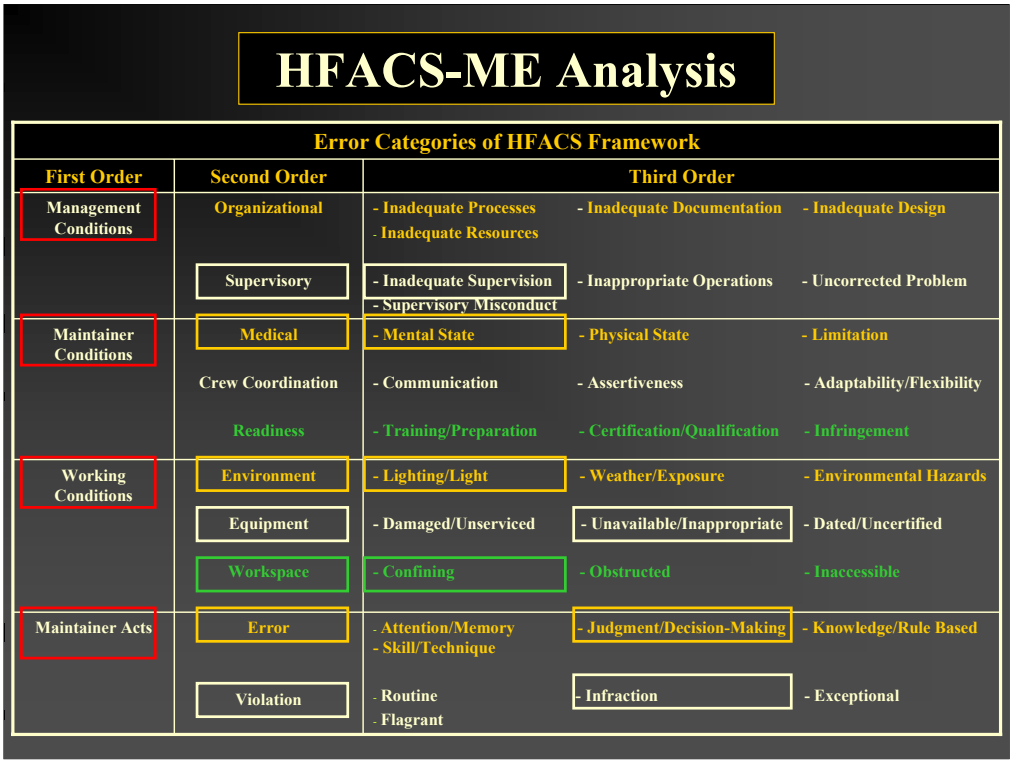
Goggles, however, protect sensitive eyes from hazards. Damage to eyes could reach Critical severity. As such, the only remaining determination for Risk is how often the potential exists for that damage. Washing aircraft (without goggles) will cause damage to your eyes less often than welding (without goggles) will. Risk goes from Medium to Extremely High because of this likelihood for injury.

Case Study: HFACS-ME with RACs

An unsupervised electrician was told to conduct some aircraft electrical repairs. A "seasoned pro", he decided that it wasn't necessary to secure power or use tags for such a small job. Unable to trace the wires adequately in the dark, confined area with his flashlight, he decided to disconnect the most likely of several wires. The electrical short destroyed several pieces of equipment.

Facilitator: Please read this slide's "Case Study" for students (it is not in the Student Guide). You may also want to have students classify the causal factors using the HFACS-ME Framework prior to advancing to the next slide for extra practice.

We will now merge our previous discussions of HFACS-ME with our new system to identify RACs.



Using the HFACS-ME Framework, an Accident Investigator would select the Error Categories shown:

Management Conditions

Supervisory - Inadequate Supervision. No supervision at all.

Maintainer Conditions

Medical – Mental State. Complacency and Over-Confidence affected his decisions on securing power, tagout procedures, and, selection of the "probable" wire without verification.

Working Conditions

Environment – Lighting/Light. Area was not adequately illuminated.

Equipment – Unavailable/Inappropriate. His flashlight was inadequate.

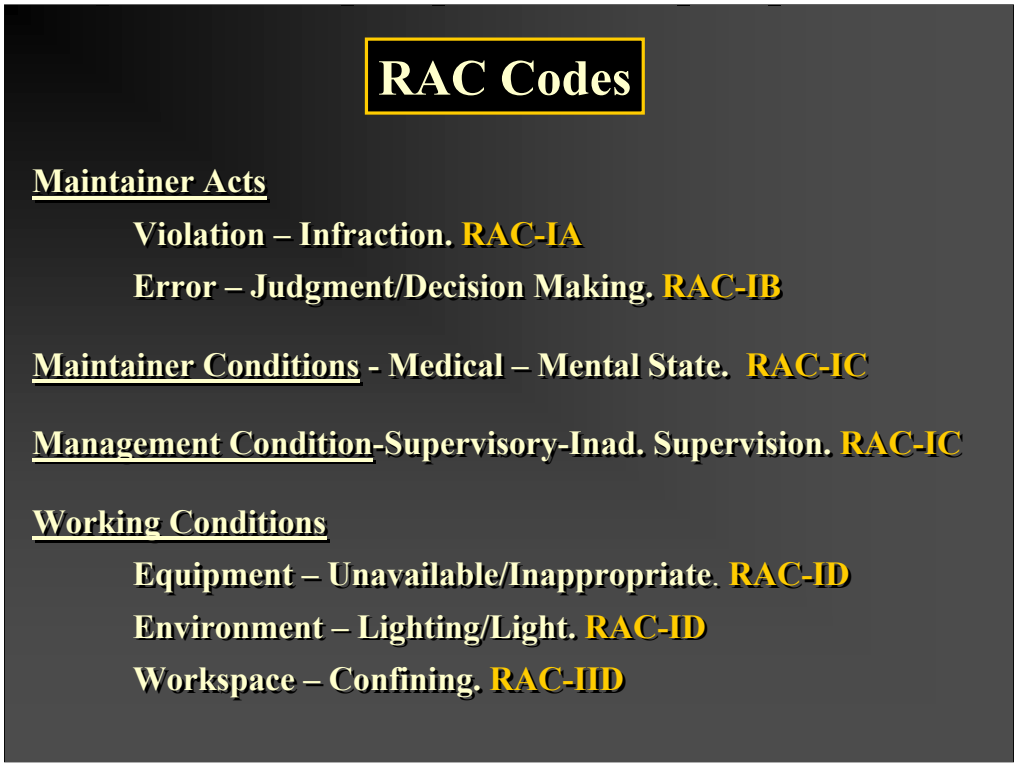
Workspace – Confining. With the poor lighting, it added some difficulty in tracing wires.

Maintainer Acts

Error – Judgment/Decision Making. Choosing to disconnect the likely wire without adequate verification.

Violation – Infraction. Ignoring tagout and power securing requirements.

Facilitator: You may wish to have students assign RAC Codes to these HFACS-ME Factors before advancing the slide.



IMPORTANT!! RACs are based on FUTURE accident potential. This exact accident may not happen again, but the individual causal factors will remain unless corrected. So we must assign RACs (and corrective actions) to our cause factors based upon their potential to cause NEW accidents.

Example: If we stopped a friend BEFORE he drove without a seat belt, there would be no accident. Because there was no accident (this time), would you assign a RAC of IVE (Unlikely-Negligible) for not using seat belts while driving. No! Lack of seat belts occasionally results in fatal accidents….so a RAC of IC would be more appropriate.

Note: Why are there no Severity III or IV levels? Because this accident reached a Critical Severity Level (in equipment damage), proving our accepted causal factors have at least Critical (or worse) Severity potential.

Infraction. IA. Not securing power while working on electrical wires will frequently cause accidents, severe injuries, or even fatalities. Our man was lucky!

Judgment/Decision Making. IB. "Guessing" the correct electrical wire is likely to result in catastrophic accidents, though it has slightly less potential than deliberately working on a live wire as noted in the infraction above.

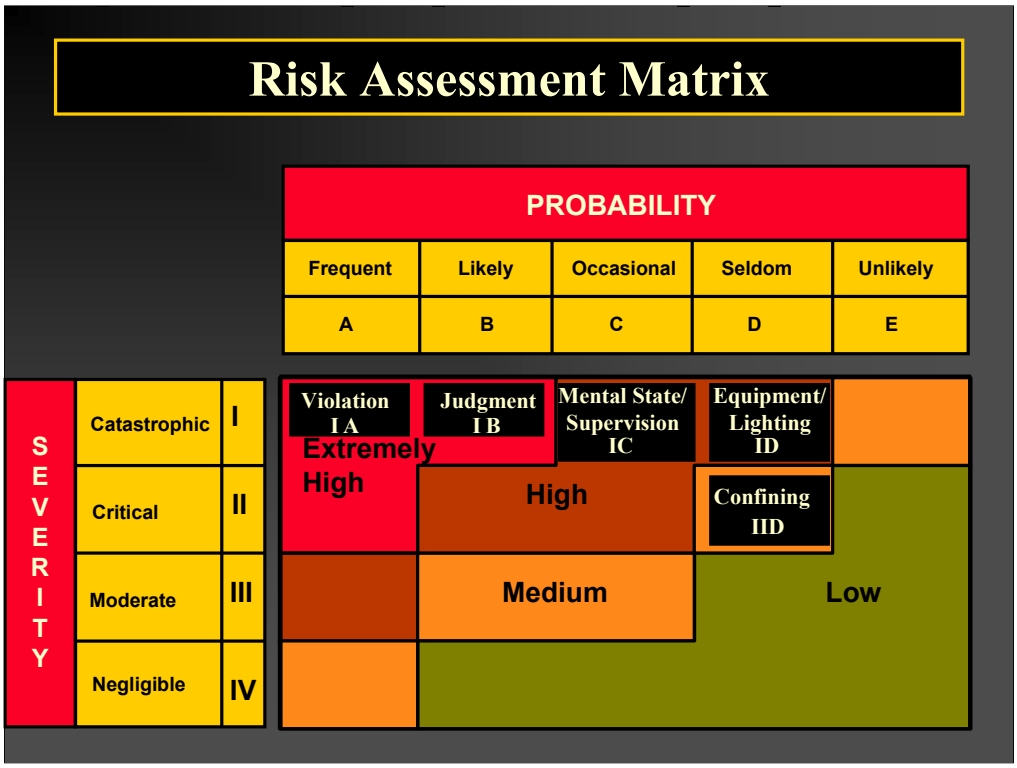
Mental State. IC. Complacency and overconfidence may cloud judgment, but professionalism should err on the side of safety. This occasionally causes catastrophic electrical accidents.

Inadequate Supervision. IC. A "seasoned pro" electrician shouldn't need much supervision. This case shows that a lack of supervision can still be a catastrophic factor amongst "professionals" who violate safety rules.

Inappropriate Equipment. ID. The flashlight was not the best, but it didn't force him to choose not to secure power or guess the wrong wire. It simple made the intended task a bit more difficult. Weak flashlights, as seen here, occasionally may contribute to potentially Catastrophic Accidents.

Lighting/Light. ID. In this case, same as Inappropriate Equipment (poor flashlight).

Confining. IID. The confining area was the least influential of the factors on his decision. He had enough light to determine "likely wires" and chose to ignore the hazards of other wires. A similar situation would seldom involve even a critical accident.



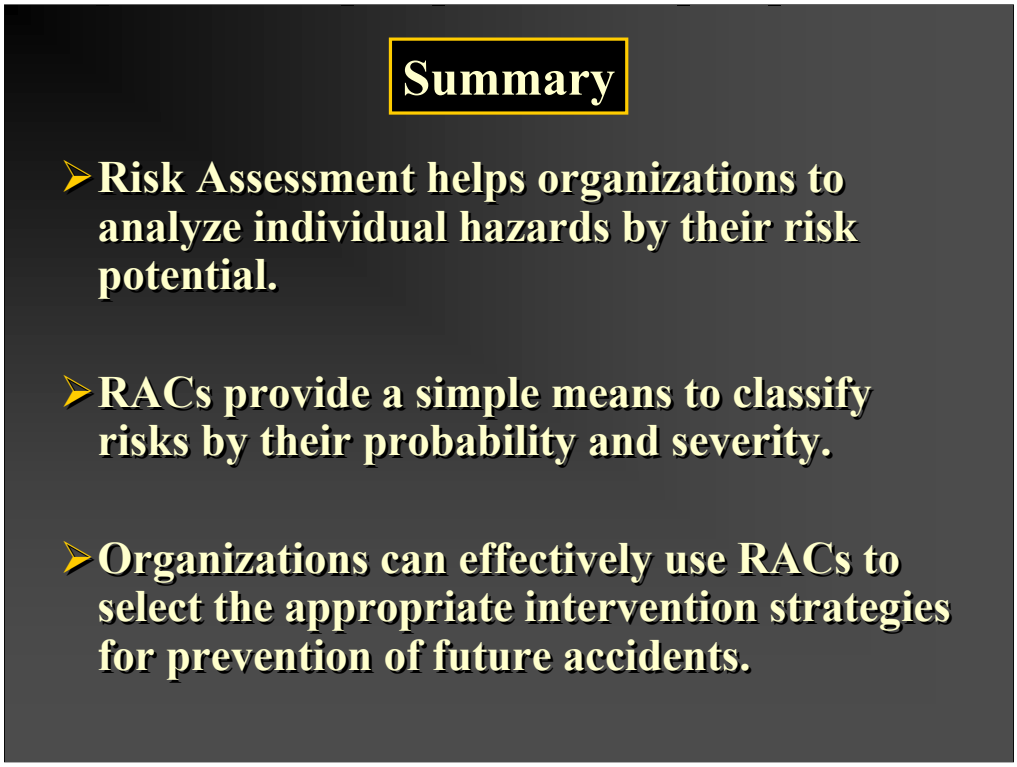
The completed Matrix shows:

1. The Violation (IA) and Judgment Errors (IB) must be corrected first (Extremely High Risk).
2. The Supervisory, Mental State, and Lighting Issues are a close second (High Risk)
3. The Confining work area is the last priority (Medium Risk)

Although in hind sight, these RACs seem to be rational, we have often chosen the wrong priorities in the past. For example, if we wanted newer aircraft (accident or not), would we spend all of our time arguing about the lowest priority factor (confining spaces) while simply writing off the others as "do more training". Would lighting be considered at all? Would Supervision?

RACs identify accident risks, not political issues or pet projects.

RACs provide the ability to prioritize accident intervention strategies.



Summary:

-Risk Assessment helps organizations to analyze individual hazards by their risk potential.

-Risk Assessment Codes (RACs) provide a simple means to classify risks by their probability and severity.

-Organizations can effectively use RACs to select the appropriate intervention strategies for prevention of future accidents.

Questions?

NTSB Photo (http://www.ntsb.gov/events/2000/aa1420/default.htm):

American Airlines Flight 1420
Little Rock, Arkansas
June 1, 1999

The accident aircraft, a McDonnell Douglas MD-82 on a regularly scheduled passenger flight from Dallas, TX, on June 1, 1999, overran the end of the runway, went down an embankment, and impacted approach light structures after landing at Little Rock airport. Thunderstorms and heavy rain were reported in the area at the time of the accident. There were 11 fatalities, including the aircraft captain, and numerous injuries among the 145 passengers and crew aboard the flight.